

SCIENCE

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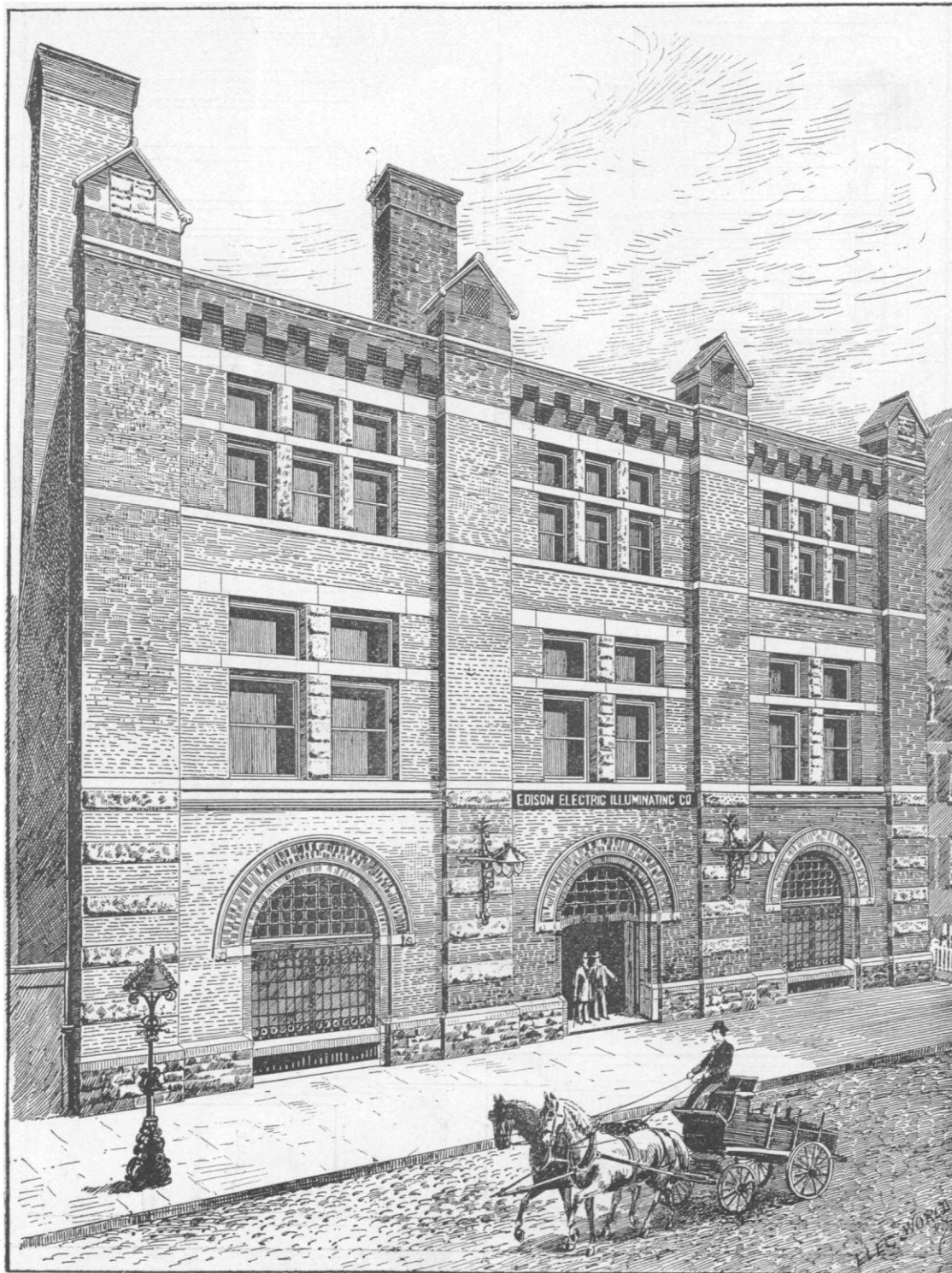


FIG. 1.— EDISON CENTRAL STATION, BROOKLYN, N.Y. (See page 36).

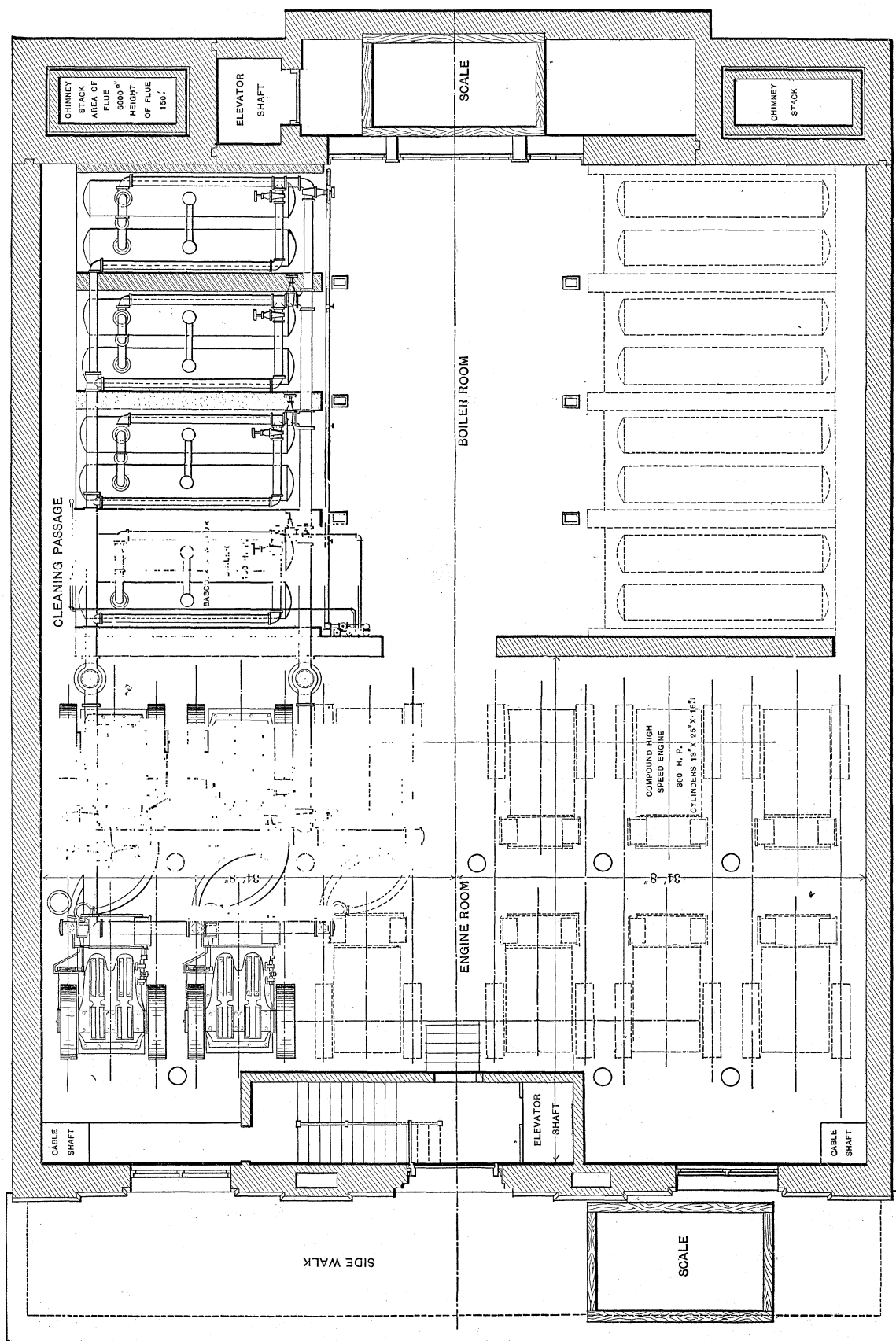


FIG. 2. — PLAN OF ENGINE AND BOILER ROOM, EDISON BROOKLYN STATION (See page 36).

Elec. World, N.Y.

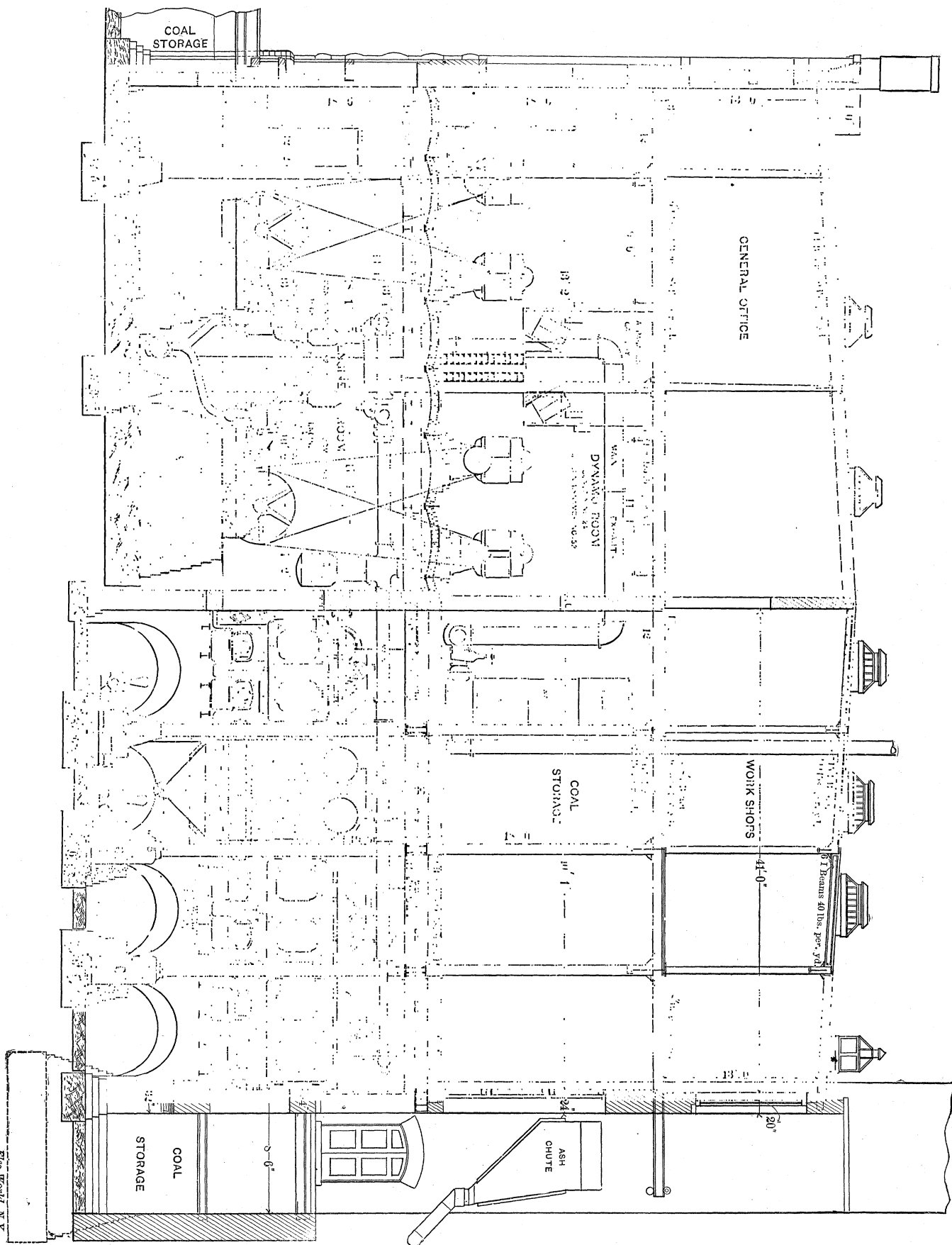


FIG. 3.—VERTICAL SECTION, EDISON BROOKLYN STATION (See page 36).

THE EDISON ELECTRIC LIGHT STATION IN BROOKLYN.

WE illustrate in this issue the central station of the Edison Illuminating Company recently completed in Brooklyn, N.Y. Fig. 1 is a view of the Pearl Street front of the building, Fig. 2 is a plan of the engine and boiler room, and Fig. 3 is a vertical section of the station. The station is designed for an ultimate capacity of 36,000 lights of 16 candle-power each. At present only about one-third of the plant is installed, that being sufficient to supply the immediate demands. The rest will be added as required.

The building, which is fire-proof throughout, is seventy-four by a hundred feet, three stories high, and is located practically in the centre of the district to be supplied. Besides the generating plant, supply rooms, store rooms, etc., the building has ample room for offices, thus enabling the company to centre all departments of its business under one roof.

Under the sidewalk are located large reserve coal vaults, the coal for immediate use being in a storage room on the second floor, over the boiler room. On the first floor are the engine and boiler rooms; the dynamos and electrical apparatus generally are on the second floor, and the third is taken up by store and supply rooms and by a suit of handsomely fitted offices. Under the engine room is a solid bed of concrete four feet thick, laid entirely apart from and independent of the wall foundations. Upon this rest the foundations for the twelve engines. In this manner all jar from the engines is absorbed or neutralized, none of it being transmitted to walls or floors.

The engines are high-speed compound Ball engines, of three hundred horse-power each, the high-pressure and low-pressure cylinders being respectively thirteen and twenty-five inches in diameter and sixteen-inch stroke of piston. These are said to be the heaviest and largest engines of their class ever built. The general arrangement of engines and boilers is shown in the plan, Fig. 2.

Steam is supplied by eight Babcock & Wilcox sectional boilers of the largest type, arranged in two groups or batteries of four each. Each boiler has about 2,800 square feet of heating surface—between six and seven square feet for each horse-power developed. The boiler room has all necessary arrangements for the convenient working of the plant. The ash-pits under the boilers, into which the ashes are raked from the furnaces, discharge into a car running on a track in the basement, which is then hoisted on an elevator, thus avoiding all shoveling and handling. The coal is elevated to the store-room, whence it is fed down to the boilers through chutes, on each of which is a special coal-scale, so that every day's supply is known, and the economy of the plant is constantly recorded. Water meters, in a similar way, record the quantity of water used. Two main steam pipes extend from the boilers to the engines, each engine and boiler being connected to both pipes, so that any boiler or engine may be disconnected without interfering with the operation of the others.

The front half of the second story is devoted to the electrical plant. The space is arranged for twenty-four Edison dynamos, each engine being belted directly to two dynamos. The dynamos run at a speed of 650 revolutions per minute, and each has a normal capacity of fifteen hundred sixteen-candle power lights. In both engine room and dynamo room overhead travelling cranes are arranged, for the convenient handling of heavy pieces of machinery.

Through the centre of the dynamo room runs what is called the "electrical gallery," to which are brought all the cables from the dynamos. In the centre of this gallery, within easy reaching distance of one person, are arranged all dynamo switches, dynamo field-boxes, ampère meters, etc., so that one man in this gallery has all the electrical apparatus under his immediate control.

From this gallery seventeen feeders run to different parts of the district to be supplied with lights. The three-wire system being used, each feeder consists of three cables, a positive, a negative, and a neutral. By the arrangement of apparatus in the gallery, the man in charge can see at a glance the total load on the dynamos, and through what feeders and in what part of the district this load is being distributed. The underground system or

net-work of wires throughout the district is all united by large mains; and the regulation of current is such that at no time is there a difference of potential of more than one volt throughout the district.

The underground system, as at present laid out, is arranged for a total of twenty thousand lights, and may be readily extended as the demand warrants. It covers an extreme distance of a mile from the station in one direction, and about three-quarters of a mile in the other, in an excellent business and residential district, from an electric lighting point of view.

The Edison system of underground tubing, which has proved so successful, has been introduced here, with many improvements and additions. The maximum drop under full load is one per cent on the mains, and there are only four sizes of tubes used in the mains, ranging respectively from 100,000 to 250,000 circular mils. Mains, as here introduced, are in larger-sized tubes than have heretofore been used, allowing more insulation compound to be introduced into the tube. All three wires in the mains are of the same size.

The Edison system of distribution is too well-known to need any extended description. Service connections can be taken off at the coupling boxes every twenty feet. At all street crossings are placed main junction boxes with busses, into which all mains at each street-crossing are brought, thereby uniting and tying the mains together at every corner, to obtain uniform distribution and pressure, and to allow more readily of a proper inspection of the system. At these boxes each main is protected by an ampère safety catch of proper size, except the neutrals, which are coupled with solid copper catches. Into certain of these junction boxes the feeders running direct from the station are connected to the system of mains. In case any feeder is disconnected, for any cause, it will not in any way affect the system, as the main which it is directly feeding will be supplied from the other feeders. In case of any accident or short circuit on the main, it does not throw off the service from any customer, as the mains are fed out to the point of trouble from both directions. Five of the feeders, instead of running to only one point of distribution, run to a certain point, and from there to two or three other points. This is to obtain better control and distribution over the system. This underground system, after completion and being thoroughly tested and started in operation, showed an insulation resistance on the whole system of over 700,000 ohms, said to be the best result in that direction ever achieved in an underground system.

THE BASIN OF THE KONGO.

A GREAT deal of interesting information concerning the Kongo, gathered from trustworthy sources, is given in the December number of the *Scottish Geographical Magazine*. The estuary of the river, between Banana Point and Shark Point is eight miles across, and soundings have indicated depths of sixty fathoms. The current at the mouth is very rapid, certainly not less than three knots an hour, or a little over five feet per second. Taking the vertical section at the mouth to be a triangle, the base of which measures eight miles and the altitude sixty fathoms, it will be found that about 1,060,000 tons of water are poured into the sea per second. The effect of this huge volume is perceptible as far as six degrees of latitude northwards from the mouth of the river, or to a distance of 360 nautical miles, so that a vessel making for Banana feels this formidable resistance after crossing the Equator, and its speed is diminished. Sailing-vessels have often to wait for weeks for a spring-tide, or a strong wind springs up, and enables them to enter the river.

Another phenomenon is the current caused by the water at the edge of the stream losing its onward velocity, and being forced back towards the land, where it spreads itself out along the coast. The ports along this coast, such as Kabinda, Loango, etc., are only roadsteads with but little shelter. Vessels have to be loaded and unloaded by lighters towed by small tugs. The lighters are sometimes overturned, when their cargo, if it be palm-oil, for instance, floats, and the owners know where it will be found on the shore. For example, any article that falls into the sea off Landana,

two miles out to sea, will arrive at the shore near Sette Cama. This current is not felt beyond Cape Lopez, for its effect is neutralized by the rivers Gabun and Ogowé.

When a vessel coming from the north arrives at about thirty miles from the mouth of the river, it crosses a clearly marked line on the surface of the water. On the side of this line towards the Atlantic the water is of the greenish, milky color which announces the proximity of land; on the other, it has the characteristic color of the river, a brownish yellow. The ship has now entered the waters of the river, though the land is scarcely yet visible. The pilot-signals, buoys, and landmarks set up by the Government, render it a very easy task to take a ship into the port of Banana. After skirting the bank at the point, she enters at once into a magnificent bay, where a whole fleet could ride at anchor. This port far surpasses all others along the coast, and it is astonishing that no one thought of occupying a spot so favorably situated at the mouth of one of the mightiest rivers of the globe until some slave-traders in the present century took up their quarters at Banana Point. Cases of illness are rare, and invalids speedily recover in this healthy spot. The heat is rendered supportable by the sea-breeze, which blows from ten o'clock in the morning.

The basin of the Kongo and its affluents has an area of about 386,000 square miles, more than thirty-three times the area of Belgium, and nearly as large as Holland, Belgium, France, Switzerland, Italy, and Ireland united. The navigable waters of the basin measure together about 7,140 miles in length. The length of both banks of the navigable waterways, 14,280 miles, is about that of the coast-line of Europe from North Cape to Constantinople. In addition to this, the Lower Kongo extends for about 120 miles from the mouth to Matadi, where the region of cataracts commences, and consists of two portions differing considerably in character. From Matadi to the Ile des Princes, or thereabouts, wild scenery, steep mountains, and torrents falling headlong into the river show that the volcanic forces which formed the region of the cataracts extended their energy over this district also. Below this island the river expands at once to double, and a little lower down to three times, its former breadth, and at last measures about twelve miles across instead of two miles and a half. It is studded with numerous islands, larger streams flow into it, its banks and the hills beside it are rounded, and the whole country has a tame appearance. Between Boma and Ponta da Lenha the islands are only banks of sand covered with grasses and sickly-looking shrubs, but below that point they bear a luxuriant vegetation.

A further diversity in the vegetation and soil is caused by the tides. The salt water ascends the river as far as Malella, so that, while the islands above are covered with oil-palms, baobabs, and wild cotton, on those towards the mouth of the river the effect of the tide may be seen in the increase of bamboos and the diminishing number of palms, etc. The latter islands are submerged at exceptionally high tides, whereas those above Malella have a fairly dense population. As soon also as the fresh water is entered, alligators and hippopotami are met with.

The navigation of the Lower Kongo is rendered difficult and dangerous by the rapid changes that take place in the depths of the channels. Some twenty years ago steamers always followed the northern bank between Ponta da Lenha and Boma, for the Fetish Rock passage was practicable only for crafts drawing less than six feet, whereas now this passage has a depth of about 190 feet, while opposite Kanga a boat drawing eleven feet of water would certainly touch ground. Several other similar cases might be quoted. Again, when the tidal waves are urged forwards with more than usual violence by the wind, which generally blows from the sea from ten o'clock in the morning, the struggle of these waves with the waters of the river is so fierce that it is felt as far as Binda, ninety-three miles from the mouth. At such times boats are obliged to keep close to the banks, or they would be swamped immediately. Ocean steamers ascend as far as Boma, and small steamers belonging to the Kongo State ply along the river up to Matadi. From the soundings taken by Captain Boyé, however, which show that the channel is nowhere less than sixty feet deep, it is considered that large steamers may safely ascend to Matadi at a speed of nine to ten knots. The large quantities of water which are poured into the river during the rainy season cause great

changes of level. The water rises gradually through June, July, and August, and attains a maximum height between the 13th and 25th of September, after which it decreases up to the middle of February, and attains a second but lower maximum at the end of April.

North of the river, between Banana and Ponta da Lenha, lies an arid plain. The soil is a compact clay interspersed with lagoons, which are flooded at high tide, and are covered with impenetrable vegetation, chiefly papyrus. At a distance of from three to twelve miles from the river the country entirely changes its aspect: here hills, 300 feet high, are separated by broad valleys, and the soil is light, and no doubt very fertile. Fifty to fifty-five miles from the river, Mayumba — i.e., the land of forests — is entered, which supplies the greater part of the merchandise shipped from the ports of the Lower Kongo, and of the coast between that river and the Gabun.

Four tribes inhabit this country; the Mussorongos, who dwell on both banks of the river and the islands between Ponta da Lenha and Banana, the N'Zaadi along the river to the east of the Mussorongos, the Kacongos to the north of these tribes, and, beyond the Kacongos again, the Mayumbas. The natives have a gentle disposition, and their barbarities are due entirely to the old-established rites of fetichism. They attack a village on slight provocation, but disturbances among the inhabitants of the same village are very rare. Drunkenness, except perhaps at the great feasts, is not a common vice. They are by no means impervious to new ideas, and, if the Government can put down the tribal wars, they will probably make great progress in civilization.

Between Matahdi and Stanley Pool merchandise has at present to be carried overland at great expense. A railway has therefore been projected to connect the upper and lower parts of the river, and thus provide a cheaper and more commodious means of transport from the interior. The distance, as the crow flies, is 174 miles, but the railway, in order to take advantage of the formation of the ground, and avoid all great engineering difficulties, will be extended to a length of 264 miles. The cost is estimated at £1,000,000 sterling.

A new edition of three sheets of M. Lannoy de Bissy's map of Africa, which embrace the greater part of the Kongo territory, has been published. Several important changes may be observed in this edition, particularly near the cataract region. The French Rouvier Mission has furnished more complete and exact information than has hitherto been attainable regarding the course of the Kuilu and the country north of Manyanga; and the Belgian Cambier Mission has supplied details concerning the country on the south bank, between Matadi and Leopoldville. The survey for the railway has also determined the position of many points more exactly. The position of Mboko Songo has been removed about 20' towards the north, and therefore the sources of the Chilungo, in the neighborhood of this place, have undergone a similar displacement, whereby the basin of the Kongo, and consequently the territory of the Kongo State, have been enlarged. The middle course of this river has also undergone changes in direction, and its affluents, the Luisa and Luali on its right bank, and the Lukula, on its left, are represented as the important streams they really are. The tributaries also which enter the Kongo in the region of the cataracts are put down from their sources to their confluences.

Between Stanley Pool and Kwamouth the river runs swiftly between mountains often six hundred to one thousand feet high, and covered with forests. Only at Msuata is this barrier broken. Here the land rises from the shore in terraces, and is inhabited. As far as Chumbiri the river widens very gradually, but above it expands considerably, and is generally very broad all the way to Stanley Falls: it is often fifteen, and sometimes as much as twenty-one, miles across. Between Bolobo and Lukokela a marshy tract occurs, a slight blemish on this beautiful river.

All along the banks of the Upper Kongo are frequent villages, and even towns. Bolobo, for instance, has a population of 30,000 souls, public squares, and regularly built streets. Considering the enormous length of waterways, and the fertility of the soil, the new railway, by which all the exports must reach the Lower Kongo, should prove a success.

NOTES AND NEWS.

A NEW stamp-cancelling machine is being tried in the Philadelphia post-office. It is operated by electricity, and is said to cancel the stamps on letters at the rate of 25,000 per hour, automatically registering the number cancelled.

— The death of Prof. Lorenzo Respighi, Director of the Osservatorio Campidoglio, Rome, which occurred on Dec. 10, is a great loss to science.

— Mr. Robert T. Hill has resigned the position of assistant professor of geology in the University of Texas, in order to devote his attention solely to geological investigations.

— An attempt is being made to secure the erection of an international monument to James Watt at Greenock, his birthplace. It is proposed that the memorial shall be a large and thoroughly equipped technical school.

— The *Detroit Journal* desires to receive, by postal card, the address of all living male and female descendants of Revolutionary officers and soldiers of 1776, and, when possible, the name and State of the ancestor.

— Dr. Sargent, Professor of Physical Culture at Harvard, utters a word of caution about over-exercise. He says, according to *The Medical and Surgical Reporter*, that those who have been most successful in heavy gymnastics are also subject to nervous complaints.

— The "Annual Catalogue" for 1889-90 is sent this year to every graduate of Harvard College whose address is known. The annual reports of the president and treasurer are sent regularly to every graduate who has informed the secretary of the university that he desires to receive them. Graduates are requested to advise the secretary of changes in their addresses.

— Test borings recently made on the line of the Nicaragua Canal show that the entire divide to be traversed by the deep cut consists of solid basalt, at least to a depth of 165 feet, as far as the borings extended. This is a most favorable showing for the construction company, as it settles at once the important question of slopes in the greater part of the cut.

— An article on the new plants introduced into cultivation during the year just past appears in *Garden and Forest* for January 8th, and in the same number Mr. Geo. Nicholson continues his description of the gardens of the Riviera. One phase of the national forest problem is discussed editorially, and a novel theory of the function of the so-called "knees" of the Bald Cypress is set forth in a communication from Dr. Robert H. Lamborn.

— At a recent meeting of the Photographic Society of Geneva, Switzerland, Professor H. Fol presented a paper on resemblances in married couples. According to the *British Journal of Photography*, he stated that, out of seventy-eight young couples photographed for the purpose of his investigations, he found that in twenty-four cases the resemblance in the personal appearance of the husband and wife was greater than that of brother and sister, in thirty cases it was equally great, and in only twenty-four was there a total absence of resemblance.

— The Meteorological Summary for the Year 1889, prepared by Professor F. H. Snow, of the University of Kansas, from observations taken at Lawrence, shows that the most notable meteorological features of the year 1889 were the remarkable absence of extremes of heat and cold, resulting in a very mild winter and a very cool summer; the abundant and well-distributed rainfall, making this one of the three wettest years on the twenty-two years record; the phenomenally warm December, whose mean temperature was six and one-half degrees above that of November; the low wind velocity; the small amount of snow; and the unusual number of fogs, averaging a little more than two per month.

— The attention of graduates of Harvard University is invited to the fact that for several years the secretary of the university has voluntarily acted as a medium of communication between persons seeking to secure educated young men to assist them in teaching, professional work, or business, and students or graduates of the university desirous of obtaining such employment. For this purpose the secretary keeps a list of graduates engaged in teaching,

another of students about to graduate who wish employment immediately thereafter, and a third of students who desire temporary work in summer vacations. The results have been satisfactory, except in respect to obtaining advantageous summer employment for students. From one to two hundred students apply for summer work each spring, but a comparatively small number obtain it through the secretary's aid. The co-operation of the alumni is invited in all three branches of this work.

— Dr. Hadjime Watanabe, an official of the Japanese agricultural service, delivered an interesting address on the chrysanthemum at the recent celebration in Berlin of the centennial of the plant's introduction into European cultivation. According to the report of his words published in *Garden and Forest*, the Japanese divide chrysanthemums into two groups, "nogiku" or wild single, and "niwagiku" or double cultivated flowers; and the latter are subdivided into four kinds — the ordinary autumn-blooming sorts, the summer-blooming, the winter-blooming, and those which bear flowers at all four seasons. The single flower is not neglected by the horticulturist, but is prized for its very simplicity, and is usually planted at the foot of rocks, intermingled with grasses, to give a landscape design a naturalistic air. In treating the double-flowered plant when it is desired to produce individual flowers of the largest possible size, then all the branches but one are gradually removed, and on this one only an isolated blossom is allowed to mature. On the other hand, when as many flowers as possible are sought without regard to conspicuous size, the main stem is brought to the greatest possible development, and all its branches are preserved until the blooming season arrives, when, if some show no buds, they are cut away. The sturdiest possible plants are chosen for this purpose, and the speaker referred to some upon which more than three hundred flowers had been counted. Two forms are in favor for these many-flowered "kikus," one of which gets its name from its resemblance to a thick broom, while the other is a more artificial, fan-like shape. A Japanese proverb says "it is easy to grow the flowers of the kiku, but difficult to grow its leaves," and the speaker declared that the plants are judged from this standpoint. The amateur's chrysanthemums are usually "very poor and faulty in foliage, although they may bear fine flowers; but those which one sees at an 'art-gardener's' are clothed from top to bottom with leaves regularly disposed and of a beautiful fresh color." The most common method of propagating the plant is by root-division, but several others are employed. In one, a single leaf with a bud at its base is plucked, lightly covered with earth and laid in a shady place, where it eventually takes root. Gardeners who own rare varieties therefore forbid the visitor a near approach to their plants, as it would be easy to pick a leaf of the proper kind and conceal it in the pocket for future planting.

— The question of the relative food value of dried corn fodder and of corn silage has been much discussed, and, judging from the fact that the discussion still continues, has not yet reached its final solution. One important element in determining this question is the relative percentage digestibility of the fodders, that is, the proportion of the ingredients of each one which the animal fed upon them is able to utilize. Some recent experiments conducted by H. P. Armsby and W. H. Caldwell at the Pennsylvania State College Agricultural Station are a contribution to this branch of the question. The material used in this experiment was ordinary field corn fed to two Devon steers. The corn was prepared in three different ways, — as rapid-filled silage, slow-filled silage, and field-cured fodder. As a result of the experiment, it was found that the dry matter of the field-cured fodder was more digestible than that of the rapid-filled silage, and this again was more digestible than that of the slow-filled silage. The digestibility of the albuminoids and of the total protein is very nearly the same in the fodder and the silage. These results do not show the effect of the process of ensilage upon the digestibility of green fodder, but only the difference in the final effects of two processes for preserving fodder. The digestibility of the green material was not determined, but in all similar investigations the digestibility of the freshly cut fodder has been invariably found to be greater than that of the same fodder after being subjected to the ordinary processes of curing. In all probability, therefore, the freshly cut corn fodder

would have proved more digestible than was either the silage or the fodder. The experiment shows merely that the process of ensilage lowered the digestibility of the material more than the process of field-curing. Furthermore, the relative digestibility of corn fodder and silage is but one element in determining their relative value. It would be a mistake to condemn silage because it appears to be slightly less digestible than the field-cured material. In forming a judgment of the comparative value of the two processes, account must be taken not only of the digestibility of the resulting fodder, but of the amount of material lost in the process, and of the nutritive value as well as the digestibility of the product; and also of its influence upon the health of the animals, and of the important practical questions of the relative convenience and economy of harvesting, storing, and handling.

— A few years ago some of the leading photographers in London went to the expense of equipping their establishments with engines and dynamos, so that, by means of the electric light, they might be to some extent independent of the sun in their work. The results were satisfactory though the cost of equipment and maintenance was high. Most of these photographers have now discarded their engines and dynamos, though still adhering to the electric light. They find it much less expensive and satisfactory to take their current from the street mains of the different electric light companies, paying only for the quantity consumed.

— In a recent lecture by Dr. A. W. Schüddekopf, on "Universities and University Life in Germany," after a short sketch of the history of German Universities, showing how they have gradually developed from the schools founded by the Church for the education of persons intending to enter its service, the lecturer explained the constitution of German Universities, their officials and teaching staff, with a digression illustrating the high social position of a German professor, despite the fact that his salary seldom exceeds \$1,500 or \$2,000 a year. The Lecture also explained at some length the position of a "privat-docent," a class of teachers peculiar to German Universities, who receive no salary for their work, but render their services gratis in the hope of being some day appointed to a professorship. He also reminded his audience of an important distinction made in Germany between the "professor ordinarius" who has a seat in the Senate of his University and is eligible for all the honorary offices — rectorship, deanship, etc., — and the "professor extraordinarius," who does not enjoy these privileges. Dr. Schüddekopf then proceeded to describe the German Universities as teaching centres. He compared the English system of higher education with the German system, stating that Universities of an exclusively examining character do not exist in Germany; whereas, on the other hand, the educational feature of Oxford and Cambridge life is absent from German Universities. The latter are of a teaching and examining character at the same time. The lecturer next laid emphasis on the looseness of the discipline for the students, compared with that maintained in England, and explained the possibility of such laxness by the greater average age of the student — it being necessary for every person matriculating at a German University to have passed his "maturitätsexamen" at his gymnasium, which is rarely tried by persons under nineteen or twenty years of age. The German student is much less frequently examined than his English brother; but then what an ordeal when it comes! Unlike the English system there is little or no paper work, the candidate being examined *viva voce*, more importance being attached to the grasp he shows of his subject, and his manner of manipulating it, than to his knowledge of facts. Besides the *viva voce*, candidates have to write one or several "dissertations," which may take many months to prepare. Dr. Schüddekopf reminded his audience that, in Germany, University degrees are not considered to qualify candidates for master-ships, for a license to practice medicine, and other offices, except in the case of candidates for a University professorship; but that candidates for such offices must have passed the "staatsexamen," which in most cases is much more difficult than the degree examinations. Relating his own experiences in passing his "staats-examen," Dr. Schüddekopf caused a tremor to run through a sympathetic audience when he told that, after a year passed in writing "dissertations" on philological and philosophical subjects,

he underwent nine hours *viva voce* examination in one day by eight German professors in as many different subjects! The majority of German students — except in the faculty of medicine — do not take a degree at all, but only pass their "staatsexamen." It is the custom in Germany for a student to have been to several Universities before settling down at one for examination purposes — a system which the lecturer thought a very good one, on account of the facility it affords the student for becoming acquainted with the leading men in his subject.

— For the benefit of delegates and others attending the eleventh convention of the National Electric Light Association, to be held at Kansas City, Feb. 11–14, arrangements have been made with the Pennsylvania Railroad to provide a vestibule train to be known as the "Electric Limited," to be run through without change to Kansas City, via Chicago and the Chicago, Burlington, and Quincy Railroad. This train will leave Jersey City on Sunday, Feb. 9, at 9.45 A.M., arriving at Chicago, Monday morning, at 9 A.M. Monday will be spent in Chicago, the Chicago Electric Club having kindly invited the Eastern delegates to enjoy its hospitality during their stay in that city. The "Electric Limited" will leave Chicago on Monday evening at 5 o'clock, arriving at Kansas City early Tuesday morning. Passengers should be careful to take the ferry at foot of Cortlandt or Desbrosses Streets, New York, not later than 9.30 Sunday morning. No effort has been spared by the transportation committee in obtaining the very best equipment, and the committee is assured that this train will be the finest ever run out of New York. It will be composed of the latest Pullman vestibule sleeping cars, lighted by electricity, a dining car, composite car containing barber shop, bath room, card room, library, writing desk, smoking room, etc., and an observation car with a large open room luxuriously furnished, as well as an observation platform. The train will be supplied throughout with fixed and portable electric lamps. Special accommodations will be provided for members accompanied by their wives. The rate of fare going, including sleeping car accommodations, will be \$39.75, and inasmuch as it is necessary to guarantee a certain number of people in order to secure this superb train, it is important that those who propose attending the Convention notify, with remittance, as promptly as possible, C. E. Stump, chairman transportation committee, Times Building, New York. Extensive preparations have been made to render this one of the most interesting conventions ever held, and it is expected that members will do their utmost to induce as large an attendance as possible.

— In the town of St. Emilion, near Bordeaux, France, is a remarkable monolithic church, probably one of the most curious of its class. According to Mr. J. H. Parker, who describes it in a recent issue of the *American Architect*, it is cut entirely out of the solid rock, and is of early Romanesque character. The precise date is uncertain, but it appears most probable that the work was commenced in the eleventh century, and carried on through the whole of the twelfth. A fragment of an inscription remains, the characters of which agree with the eleventh century; but some of the French antiquaries attribute it to the ninth. Others consider it as merely the crypt of the church above on the top of the rock; but that church is of much later character, and it is much more probable that the subterranean church was first made, and the other built long afterwards, when the country was in a more settled state. This church is one hundred and fifteen feet long by eighty feet wide. It consists of three parallel aisles, or rather a nave and two aisles, with plain, barrel-shaped vaults; if they can be so called, with transverse vaults or openings, and round arches on massive square piers. The impostes are of the plain early Norman character, merely a square projection chamfered off on the under side, but one of them is enriched with the billet ornament. There are recesses for tombs down the sides, and a fourth aisle or passage has been cut out on the south side, apparently for tombs only, as it has recesses on both sides to receive the stone coffins. Still farther to the south, but connected by a passage, is a circular chamber in an unfinished state, with a domical vault, and an opening in the centre to a shaft which is carried up to the surface. Whether this was intended for a chapter-house, or for a sepulchral chapel in imitation of the Holy Sepulchre, is an undecided point. This sub-

terranean church or crypt is necessarily lighted from one end only, where it is flush with the face of the rock; and these openings are filled with flamboyant windows, which are very evident insertions. On the surface of the hill over this church, but with a large space of solid rock intervening, is the tower and spire belonging to it. The tower is of late Norman and transitional character surmounted by a flamboyant crocketed spire. There is a kind of well or flue cut through the rock under the tower into the church below, apparently for the bell-ropes. In the church are remains of early painting, and some shallow sculpture, the character of which appears to be of the twelfth century. Adjoining the church, on the south side, is a detached chapel of transition Norman work, with an apse vaulted with good ribs and vaulting shafts. A considerable part of the old painting is preserved. Some of the ribs are painted with zig-zags. Under this chapel is a crypt or cave cut out of the rock, called the Grotto of St. Emilion, with a spring of water in it. The work is of the same early character as the other vaults.

— A factory chimney, said to be the highest in the world, is now being erected at the Royal Smelting Works, near Freiburg, in Saxony. The horizontal flue from the works to the chimney is 1,093 yards long; it crosses the river Mulde, and then takes an upward course of 197 feet to the top of the hill upon which the chimney is being built. The base of the structure is thirty-nine feet square by thirty feet in height, on which is placed a short octagonal transition, from which the round shaft starts. This is 430 feet high, or together with the base, 460 feet high, with an inside diameter of twenty-three feet at the bottom, and sixteen feet and six inches at the top. It will take 1,500,000 bricks, and the cost is about thirty thousand dollars.

— Complaints of overpressure in schools are as numerous and universal in Sweden as in many other Continental countries. Sweden is, in fact, one of the countries where this fact has first roused the public interest, as has been proved by Professor Dr. Key several years ago, in a pamphlet full of trustworthy statistical information, and showing that anæmia, chlorosis, and other diseases are due to, or are at least greatly promoted by, the existing overwork in the schools. Another weighty charge against the present school-system is that it, to a great extent, promotes the ordinary contempt for manual work among the young, and tends to engender disinclination for the practical professions, handicrafts not being sufficiently "genteel." Complaints of a too great influx at the universities are, therefore, as common in Sweden as in Germany, and the other Scandinavian countries. These unhappy results of the secondary education are now acknowledged by nearly every body, but they were foreseen by some patriotic men, who, thirteen years ago, founded a school, which, after its headmaster, got the name of "Palmgren's Practical Work-School." However, one must not infer from the name that it gives instruction solely in manual work. It was also intended to give a liberal education, and has now gloriously proved its efficiency in that respect, as some of its pupils have, during the last two years, successfully obtained their matriculation degree. The school-lessons are here somewhat fewer than in ordinary schools, and instruction in manual work — Sloyd — is obligatory for all pupils. Moreover, children who do not attend the school-lessons are admitted to the Sloyd instruction at a very moderate fee. Instruction is also given to men and women in sewing, embroidering in gold and silver, lace-making, macramé, etc. Further in bookbinding, pasteboard-work, joinery and turning. There are also courses at the school, of three months each, for future male and female Sloyd-teachers. Besides instruction in Sloyd-work, these students have lessons in drawing and the pedagogics of Sloyd. They have also to instruct children in Sloyd for one to two hours a day, under the superintendence of their teachers. During the summer holidays a shorter course is given for ordinary teachers. To give the reader an adequate idea of the interest which nearly all classes in Sweden take in Sloyd, the Swedish correspondent of the *Journal of Education* mentions that Colonel Ankarcrona, Commander of the Royal Swedish Lifeguards, has ordered that Sloyd-instruction is to be given twice a week to the guardsmen, by experienced teachers from Mr. Palmgren's school. This step has been taken to give the soldiers some pleasant and useful recreation when they are off duty. Apart from the moral

influence it may exert, it will evidently be a great advantage for the soldiers to learn the rudiments of a trade in the barracks, which hitherto have not been a school for useful and profitable arts in Sweden any more than in other countries.

— The Standing Executive Committee of the Convention of American Instructors of the Deaf, of which Dr. E. M. Gallaudet Kendall Green, Washington, D.C., is chairman, have had under consideration the suggestions made in many quarters that, in view of the probability of a notable national celebration being held in 1892, in this country, the Convention, which would naturally meet in 1890, be postponed until the jubilee year. It is well known that an invitation to hold the next Convention at the New York Institution for the Deaf and Dumb was accepted some time ago, and that it was intended, through invitations to professional brethren in other countries, to give the Convention an international character. Since this plan was decided on it has become practically certain that there will be held, in 1892, one or more great exhibitions calculated to attract visitors even from foreign countries, and that, consequently, during that year, low rates of travel to and in our country will be offered, all of which would tend to induce a larger attendance at such a Convention from abroad, and probably from the States, than could be expected at any other time within the next decade. The influence of such a Convention, held when great numbers of people, both foreign and native, would be assembled at the place where the Convention would be likely to meet, would give its proceedings an influence and importance they could hardly have under other circumstances. The weight of these considerations has led the Committee to decide, unanimously, to postpone the meeting of the next Convention until 1892. The authorities of the New York Institution have kindly renewed their offer of hospitality, but the Committee are of opinion that it will be wise to defer their decision as to the place of holding the Convention until the plans for the national celebration are more fully developed than they now are.

— Life at Girton is described in *The Women's World* in this way: An early breakfast, served from eight to nine (some industrious students begin their day with a private breakfast party at five or six, and only partake of the college meal as an afterthought), is followed by a morning devoted, almost without exception, to private study, or to attendance at lectures given in college by the resident lecturers, or at the numerous courses in Cambridge now thrown open to women. The early hours of the afternoon, which by common agreement of the students are considered "noise-hours," are usually given to recreation, tennis being the most popular form of outdoor amusement, and pianos, with an occasional fiddle, having full swing indoors. After luncheon coffee-parties are also a common occurrence, the entertainment being of the most informal description, while the hostess seldom scruples to dismiss her guests or leave them to entertain themselves if she has work or lectures on hand. From three until the six o'clock dinner silence reigns again in the college. Many classical and mathematical lectures are given at this time by Cambridge lecturers, who come out to the college for the purpose, and the students who have not lectures usually, though not so universally as in the morning, devote a part or the whole of these hours to private study. After dinner again informal coffee or tea parties are frequent, and friends generally meet in a haphazard kind of way, which, perhaps, may be best described as "loafing" into each other's rooms. In the May term this "loafing" takes place round the grounds, and an interesting study of shawls might be made from the windows overlooking the lawn and tennis courts. The formal social duty of calling on freshers is performed in this after-dinner hour, most of the college business is transacted, meetings are held, and subscriptions to the various societies paid. In the May term it is the favorite hour for tennis, and in all three terms the fire-brigade has a fortnightly practice immediately after "hall." Some of the poorer specimens of Girtonians think this a little severe, as the practice often includes a double-quick march from end to end of the long corridors; but the officers are inexorable, and catalogue all who brave their scorn and fight shy of the brigade as "ill or lazy." From half-past seven to nine are "silence hours" again and then, or later in the evening, an hour or two's work is com-

monly done — freshers with “little-go” on the brain, are reported to get in four or five before retiring for the night, but they generally learn in a term or two that it does not pay. Nine P.M. is the orthodox hour for knocking off work, and for the more elaborate forms of social intercourse, club meetings, occasional dances, small debates, and so forth — above all, for the regulation formal tea-party. There are certain points about this entertainment peculiar to college life, if not to Girton, says the *Women's World*, notably the fact that the guests bring, not their own mugs merely, but a whole trayful of refreshments. The college custom is to send to all the rooms a tray, with a roll and butter, and the materials for whatever beverage — tea, coffee, cocoa, or plain milk — is preferred by each student, and this custom greatly facilitates the discharge of the social duty. For it is understood that when a student gives a nine-o'clock tea-party all the guests take their own trays, the hostess providing only the hot water, and such luxuries as cake and jam. Thus, at 9 P.M., in all the corridors, is presented the striking spectacle of students hurrying in all directions — sharp corners are very dangerous at this time — to their respective entertainments, balancing trays in one hand, and in the other, unless they are such old hands as to know the college blindfold and avoid all pitfalls of boots, water-cans, and unexpected angles, carrying candles in case the festivities should outlast the college lights. It is at these parties that new students are first initiated into college society, and so strong is the instinct of hospitality that the “freshman” must be of a remarkably gregarious disposition who does not find tea-parties, which she experiences in their most formal tedious aspect, grow decidedly monotonous after a few weeks.

— The high price of gum acacia has led Trojanowsky to seek for a substitute, says an exchange, and this he believes may be found in the mucilage of flaxseed. By boiling the seed with water and precipitating the strained decoction with twice its volume of alcohol, he obtained a substance which, after drying, consisted of opaque, yellowish-brown irregular fragments, somewhat brittle, but not easily reduced to powder, dissolving in water to a turbid mucilaginous solution; of this, five grains were sufficient to emulsionize an ounce of cod liver oil. The large quantity of alcohol, however, required for the precipitation, and the difficulty of drying the adhesive product being such serious objections, further experiments were made, and, by still employing flaxseed as the source of the mucilage, and treating with sulphuric acid, a gum more closely resembling acacia was obtained. His method is to boil one part of flaxseed with eight of dilute sulphuric acid and eight parts of water, until the mixture, which at first thickens, becomes quite fluid; this is then strained through muslin, and to the strained fluid is added four times its volume of strong alcohol, the precipitate being collected on a filter, washed with alcohol, and dried. The gum is in the form of translucent, grayish-brown, brittle fragments, easily pulverized, and without odor or taste, and thirty grains will emulsionize an ounce of cod liver oil.

— An insect destructive to wheat, but previously unknown in this country, has appeared in considerable numbers on the Cornell University farm at Ithaca. Mr. J. H. Comstock, professor of entomology at Cornell, who has been making a study of the insect, says that he does not know of its occurrence anywhere else in this State; but as it is extremely abundant on the University farm, it is doubtless spread over a considerable area. It was first observed there two years ago, by one of the students, the late Mr. S. H. Crossman, while making an investigation of wheat insects. On examining the stalks of wheat at harvest time by splitting them throughout their length, it was found that some of them had been tunneled by an insect larva. This larva had eaten a passage through each of the joints, so that it could pass freely from one end of the cavity of the straw to the other. In addition to tunneling the joints, they had also fed more or less on the inner surface of the straw between the joints. If infested straws be examined a week or ten days before the ripening of the wheat, the cause of this injury can be found at work within them. It is at that time a yellowish, milky-white worm, varying in size from one-fifth of an inch to half an inch in length. The smaller ones may not have bored through a single joint; while the larger ones will have tunneled all of them, except, perhaps, the one next to the ground.

As the grain becomes ripe the larva works its way toward the ground; and at the time of the harvest the greater number of them have penetrated to the root.

— The Boston correspondent of *The Book Buyer* quotes an amusing letter sent by Mr. Aldrich to Professor E. S. Morse, ex-president of the American Association for the Advancement of Science. Professor Morse, it should be said, has a handwriting quite indescribable in illegibility: “My Dear Mr. Morse: It was very pleasant to me to get a letter from you the other day. Perhaps I should have found it pleasanter if I had been able to decipher it. I don't think that I mastered any thing beyond the date (which I knew) and the signature (which I guessed at). There's a singular and a perpetual charm in a letter of yours; it never grows old, it never loses its novelty. One can say to one's self every morning, ‘There's that letter of Morse's. I haven't read it yet. I think I'll take another shy at it to-day, and maybe I shall be able in the course of a few years to make out what he means by those t's that look like w's and those i's that haven't any eyebrows.’ Other letters are read and thrown away and forgotten, but yours are kept forever — unread. One of them will last a reasonable man a lifetime.”

— No subject can be of more vital importance to the farmers of Indiana than the economical utilization of their fodder crops, since their success with live stock and in the dairy must be directly proportional to the economy of this utilization and depend for success or failure on the skill exercised in feeding. Careful inquiry and observation extending over the entire State, by the State Agricultural Experiment Station, of which Dr. H. E. Stockbridge is the director, forces the inevitable conclusion that as much nutriment in the form of fodder is wasted every year as actually finds its way into the digestive systems of the farm animals of the State. The two great fodder crops necessarily considered in this connection are hay and corn stover. Though perhaps both are equally worthy of consideration, and the utilization of each equally capable of improvement, the December bulletin, by J. Troop, pertains only to the former. It is the intention of the station to devote special attention to the production, curing, and feeding of hay during the coming season. That the results of the work may be most effective, however, it seems necessary that a preliminary discussion of the grasses of the State is called for, and to meet this demand the present bulletin is issued. It does not purport to be a scientific treatise on the grasses of Indiana; its sole aim is to offer the farmers of the State the briefest possible description of every grass known to grow within its borders, together with the chief characteristics and relative value for feeding purposes of each, in the hope of placing the farmers in possession of such information as will enable them to determine for themselves the character and adaptations of grasses with which their experience may bring them in contact. Recognizing the fact that plant determination by mere description is necessarily attended by serious difficulties, a large number of illustrations have been utilized as conveying the most perfect impression possible of the actual appearance of the grasses discussed. So far as the actual importance of the work thus begun may become to the agricultural interests of Indiana, the relations existing between tilled land and grass land in the State must be pertinent. The area of tilled land in Indiana is 56.4 per cent of the area of the State, while the grass-land area is 11.8 per cent, the average for the entire United States being respectively 41.6 per cent and 11.5 per cent. The ratio existing between these two varieties of farm land is, for Indiana, as 1 of grass land to 5.4 of tilled land, and for the entire country, 1 of grass to 3.7 of tilled land, — figures showing conclusively that Indiana can lay small claims at present to either a grazing, stock, or dairy pre-eminence, and that she falls far short of producing her best proportion of the grass of the country, and fails in maintaining a just or most profitable relation between these two staple divisions of farm lands. Indeed, Indiana ranks in the second series of States in the production of grass, and in the third series in average value of milch cows and live stock, facts which must possess a definite relation to the proportion existing between grass product and area of tilled lands, and enforcing the proverb, “the more grass the more stock, the more stock the more manure, the more manure the more crops.”

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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THE WAITOMO CAVES, NEW ZEALAND.

IN a report to the Surveyor-General of New Zealand, Mr. Thomas Humphries gives an interesting description of a visit which he and a small party made in June last to the Waitomo caves, King Country, in the North Island of New Zealand. The Waitomo River, a tributary of the Waipa, which passes through these caves, lies about eighty-five miles south of Auckland in a direct line, though it is about twenty miles further by rail and road. The caves are about ten miles from Otorohanga railway station. The country around is undulating. A quarter of a mile before the caves are reached, the Waitomo, of about twenty feet in width, is seen emerging from the side of a hill, under which it has meandered through limestone caverns of various sizes for about twenty chains. A light canoe can be taken along the river through the caves to within a few chains of its egress, where further progress is barred by the roof coming down to the water.

At the entrance to the cavern the stream is eight feet deep. The natives have never had the courage to enter. The entrance to the cave, thirty feet wide and twenty feet high, is in the face of a cliff. It is beautifully arched, with numerous moss and lichen-covered stalactites. In a canoe the visitor is taken in, ninety feet from the entrance, and landed on a silt-covered beach. By the aid of candles, for all is now dark, he finds himself among ponderous stalactites, three to six feet thick, reaching from the roof, twenty feet high, to within a foot of the ground. Everywhere, all over the extensive and intricate caverns, are seen stalactites and stalagmites of immense size, in vast numbers, with marvellous beauty of form

and color. At one place the dark vault was studded with thousands of glow-worms, giving the vault the appearance of a starlit sky.

Passing down the left bank of the stream for one hundred and forty feet, over a large deposit left by floods, the party crossed it by means of a foot-bridge. From the entrance to the bridge the cavern averages fifty feet broad, and from twenty to thirty feet high. After crossing the bridge, a sharp turn to the right is made up a steep incline for a distance of seventy feet, to the foot of a ten-foot ladder, which leads to a narrow passage four feet wide and fifteen feet high, the entrance to the "Grand Cavern." Here is the bottom of the "well," a narrow shaft running up to another series of caves over the lower ones, where it is again met with in the gallery above. The well is four feet across, perfectly true, as if made by human hands, and its sides beautifully marked with horizontal streaks, formed of laminated lime-stone. In the Grand Cavern is an immense mound of material evidently fallen from the roof.

Beyond the Grand Cavern the roof rises and forms two domes, one fifty feet high. High up, forty feet, is the entrance to another cavern. Beyond the dome there is a sudden fall, the roof lowering so much that the visitor has to stoop. The length of the Grand Cavern, at the end of which the stream is again met with, is two hundred and fifty feet. It varies in width from fifteen to forty feet, and from twenty to fifty feet in height. Up to this point the color is a dull brown and a light yellow; but in the upper galleries, thirty feet above, there are alabaster and Parian-marble-like scenes of unsurpassed loveliness.

Twenty feet above the Grand Gallery is the "Organ Gallery," so-called from the appearance of the great stalagmitic mass one hundred and fifty feet from its entrance, rising tier upon tier, like the front of an organ with marble pipes. From the Grand Gallery the Main Gallery above is reached by a twenty-five-foot ladder, and sixty feet along it the "well" is reached. Here it is twelve feet in diameter, with smooth sides of hard limestone, and the sound of moving water below. This is forty-five feet above where it was first seen. Fifty feet along from the upper well is a "fairy grotto," and through an archway thirty feet in length the "Banquet Chamber" is reached, where the surveyor and his friends found a hot dinner had been provided by the natives who own the caves. At the end of this chamber is the White Terrace, a stalagmitic mass rising in a series of terraces. From this the upper entrance to the caves is reached, high in a wooded cliff, sixty feet above and directly over the lower entrance. Mr. Humphries describes in glowing terms other galleries and caves, but this may suffice to show, that, notwithstanding the destruction of the Rotomahana Terraces, New Zealand has still plenty of wonders.

THE WENSTROM DYNAMO.

SOME months ago a description and illustrations of the Wenstrom dynamo were given in these columns. A dynamo of this make was recently sent to the electrical testing bureau of the Johns Hopkins University, where it was submitted to a series of tests, the results of which are given below, under the signatures of Drs. G. A. Liebig, Louis Duncan, and W. F. Hasson. It may be mentioned here that the dynamo tested was designed to give an output of 400 ampères, at 110 volts, running at a speed of 500 revolutions per minute; while the speed under which the tests were made was only 330 revolutions per minute.

"The dynamo electric machine sent to us for examination, a report of which is contained in the following pages, was described by the manufacturers as an 800-light dynamo, and was stated to absorb energy, when doing full duty, at the rate of about sixty-horse-power.

"Having our source of motive power and testing apparatus already in place for the purpose of conducting some experiments on other dynamos, the following tests were made (through the kindness of Mr. F. Hambleton, who consented to allow the bureau the use of a part of the works under his charge), at the plant of the Consolidated Gas Company of this city [Baltimore].

"Here we had set up an Armington & Sims engine of about seventy-horse power capacity; belted to which was a Tatham

dynamometer, which in turn was connected by a belt with the dynamo under examination. At a convenient distance from the dynamo were located the lamps and resistances (resistance coils), through which the current furnished by the former was allowed to flow, as well as the various instruments employed in the electrical measurements. Steam for the engine was furnished by a set of boilers located near by, but in a separate building.

"The source of motive power was, as stated before, an Arming-ton & Sims engine, rated, nominally, at about seventy horse-power when supplied with steam at about eighty pounds pressure. The normal speed of the engine was about 275 revolutions per minute, but this could be varied within limits of a considerable range, without any serious interference with the action of the governor.

"For measuring the power supplied to the dynamo, there was employed a dynamometer originally designed by W. P. Tatham of Philadelphia. This instrument was the same as that used some years ago by the committee appointed by the Franklin Institute of Philadelphia to conduct the competitive tests of dynamos exhibited at the Electrical Exhibition held in Philadelphia in 1885. A description of the apparatus will be found in the *Journal of the Franklin Institute*, November, 1885.

"For measuring the current furnished by the machine, there were employed two methods, the full-load current being 400 amperes, — too great for any single instrument in our possession, — a part of this was measured by a Thomson balance, and part by observing the potential difference between the ends of several heavy strips of German silver immersed in oil. The latter method is known generally as the method of fixed resistances, and the apparatus referred to was standardized by observing the difference of potential at its terminals, when a current of known value, as measured by the Thomson balance, was allowed to pass through it.

"In the measurement of electromotive force there was used a Weston voltmeter, received only a few days previously from the laboratory of Mr. Edward Weston, where it had been standardized. This, however, as well as the other measuring apparatus, was, after the completion of the test, carefully calibrated in the physical laboratory of this university.

"It may be stated that owing to the construction of the measuring apparatus employed, and also to the circumstances that a considerable distance separated the instruments used from the dynamo, no magnetic influence could have interfered with the accuracy of their indications. Before measuring the power absorbed by the dynamo, the dynamometer was run without load, in order to determine its own friction. This amount of power consumed was, in all cases, subtracted from subsequent measurements. The friction of the dynamo itself was determined by running it on open circuit, and with the brushes removed.

"The order of making the tests was as follows: first, the dynamometer was run without load; second, the dynamo was run on open circuit, brushes removed (this measurement gives friction of dynamo); third, the dynamo brushes were placed in position (this measurement represents losses due to friction in bearings, losses due to heating of field magnet wires, losses due to reversals of magnetism of armatures, core, and losses due to Foucault currents in the armature). These losses are, for a given speed, nearly constant. After this, the dynamo circuit was made, and measurements of power, current, and electro-motive force at different loads were begun. The following table gives the results of the several determinations.

Current.	Electro-motive force.	Horse Power.	Dynamometer Horse Power.	Loss.	Losses, Friction, Reversals, etc.	Losses Current ² × Resistance.	Efficiency.
134.8	114.0	20.6	24.97	4.4	4.4	.17	82.5
194.1	115.6	30.1	35.3	5.2	4.5	.38	85.2
371.6	98.3	49.0	54.5	5.5	3.5	1.30	89.9
400.0	110.0	58.9	64.7	5.8	4.1	1.50	91.0

"Speed of dynamo, 330 revolutions per minute."

A NEW USE FOR THE PHONOGRAPH.

At a meeting of the Massachusetts Medical Society on Nov. 20, A. N. Blodgett, M.D., made some interesting remarks on the use of the graphophone or phonograph in taking and recording the clinical history of a patient. As reported in the *Boston Medical and Surgical Journal*, Dr. Blodgett spoke as follows:—

"Some time ago my attention was called to this instrument, about which I had known something, although not in its present state of perfection. It occurred to me that this might be of interest to physicians in various ways, and particularly to those connected with public institutions. As you have seen, by speaking into the mouth-piece a record can be produced upon the yielding cylinder of wax, which will remain permanent, and can be reproduced a great many times.

"Last night Mr. Thomas and I made experiments at the City Hospital on a patient just admitted to the accident room. His clinical history was taken; but it was not in all respects a success, because he had an injury preventing his speaking with much force, it being a fracture of the ribs. But we got a record from an actual patient in an actual examination which was reproducible and could be understood. Later we got another record from a hypothetical patient; namely, one of the house-officers of the hospital, who was questioned in the same way as would be an ordinary patient admitted under circumstances which precluded any previous knowledge of him or his condition. That record was more distinct, could be very well understood, and I am sure any one with a little practice could use this machine in a way to obtain durable and trustworthy records from the lips of the patient.

"An instrument of this kind might be made portable, and a visiting physician in a hospital might give his directions into the funnel, when they would be recorded upon a small cylinder, which can be put upon another machine, and the physician's directions as to treatment or his description of lesions can thus be accurately recorded. This record is got by means of the graphophone, which is used a great deal in conjunction with the typewriter. I know how difficult it is to get full directions in the wards from the visiting physician, and here we have the means of an absolute record. In medico-legal cases I think it would be of great service because the utterances of the patient could be reproduced at an indefinite period afterward, and I should suppose would be evidence in the case."

HEALTH MATTERS.

Hallucinations in Alcoholism.

DR. F. W. MANN, in a paper upon alcoholic hallucination read before the Detroit Medical and Library Association, brings together some facts and theories which are published in the *Physician and Surgeon*, November, 1889:—

"The visual hallucinations of alcoholics are exceedingly varied. They may be hideous, grotesque, or awful, or they may be gorgeous, splendid, or inspiring. Unpleasant features usually predominate, and the patient is puzzled and tormented by the presence of rats, mice, beetles, worms, fleas, and other insects. This condition of zoöscopic hallucination is one of the commonest among the phenomena of alcohol poisoning.

"I do not recall having seen any explanation of the reason why animals enter so largely into the composition of the primary illusions of alcohol. These illusions a little interrogation of the patient will usually substantiate as present. A patient only the other day declared how he saw a rhinoceros, several huge elephants, and strange-looking reptiles browsing in the yard.

"A word should be said on the snake hallucination. Disorders of this kind are associated in the popular imagination with excesses in the use of alcohol. 'Seeing snakes' is in reality not a common experience. The two or three cases we have seen convince us, however, there is some basis for esteeming this one of the occasional retributions of excessive zeal in devotion to Bacchus.

"The snake hallucination is difficult to explain. Disturbances in the peripheral organs of vision seem hardly competent to account for such aggravated symptoms, although there are facts suggesting the plausibility of such an explanation. A patient in a

room where the pattern of the wall-paper or the carpet abounds in geometrical figures and circles, is apt to find these endowed with gyratory movement, and as a result may come to imagine snakes about him. But the usual causes of this hallucination seem central in origin and due to pre-existing imaginative impulse. Why should this impulse assume the snake form? May not the explanation lie in the facts of nascent consciousness? We know that stimuli cannot be co-ordinated without some ganglion through which they are brought into relation. In effecting this co-ordination the ganglion must necessarily be subject to the influences of each stimulus and must undergo a succession of changes. This action and its re-action implying perpetual experiences of resemblances and differences constitutes, according to psychologists, the raw material of consciousness. Therefore, as a corollary of this process, Herbert Spencer asserts, that, as 'consciousness is developed, some kind of instinct becomes nascent.' That there is a nascent instinctive dread of the serpent in man and monkey is obvious. There is every reason for it. The early history of our race abounds with record and tradition of that internecine strife between man and the serpent. We find the serpent permeating all his mythology, a chief feature of his legends, inscribed on his monuments, engraved on his symbols, and worshipped as his God.

"Even before this period the dread of the serpent may have been implanted in our human neuroplasm. Dr. A. E. Brown recently made some experiments in the Philadelphia Zoölogical Gardens, and found that monkeys, who, born and reared within the gardens, had never seen a reptile, yet exhibited great fear and curiosity when a snake was placed in their cage. An alligator or turtle caused no surprise whatever. Other animals, like the ox and the hog, were either perfectly indifferent, or manifested no fear of the snake."

Dr. Frank W. Brown said: "I cannot altogether agree with the Doctor as to the important part taken by nascent consciousness in the creation of these hallucinations. I do not think that nascent consciousness enters largely into the formation of the most common of all forms, primary hallucinations; that is, into those first, simple hallucinations which, if continued (and the majority of them are not), may grow to be more elaborate. Nascent consciousness does, however, have much to do with the elaboration. In the graphic descriptions of the struggles of the legal gentleman it would be interesting to know whether he conceived the snakes before the sentence of the judge, or whether they grew in his construction of that sentence; for in the former case they would be a primary hallucination and in the latter an outgrowth of elaboration. Primary hallucinations, I think, arise largely from misinterpreted perceptions — false cognition. The nerve cells, weakened by continued onslaught of alcohol, no longer possess the power of discrimination: they are content to resolve perceptions in the slightest possible way. Just as in that pathological state characterized by onomatopoeia, where the patient lapses into that simple language which names animals by their sounds, so may the weakened nerve-cells of the alcoholic be content to picture living things at the behest of a suggestive touch.

"Bugs, ants, mice, and rats are common hallucinations, but they are generally found first on the body and then afterwards in the room and on the furniture. The appearance first on the body can be explained on the supposition that the hallucination was created by a dermic sensation, or of formication, which would quickly lead, through imperfect cognition, to the conception of a bug or an ant, and then secondarily manifested as a visual hallucination. When seen first on walls or bed, they may be suggested by the so-called *muscæ volitantes*, not uncommon in delirium. As a refinement of this idea, could not the primary hallucination of snakes be brought about through misinterpretation of a *cutis anserina*, which sweeps coldly, wave-like, and rhythmically over a portion of the body? If this process seems complicated, it might explain the infrequency of snakes as an hallucination. Other hallucinations arising in the way I have indicated can be brought about by the red flashes, dust, retinal irritation, which often precedes active delirium, and which suggest a fire, or, more elaborated, a hell; ringing in the ears, a cataract, etc. As to the part taken by nascent consciousness in the creation of the reptiles in the snake case given by the Doctor, I might say that he has been a witness against

himself, in that he has not exaggerated in his vivid description of those miserable forefathers of ours in their sometimes unsuccessful attempts to avoid their most uncanny if not most horrible enemy, and from whom we consequently derive one of our most pronounced examples of nascent consciousness. If, then, nascent consciousness be a leading factor in the production of hallucinations, why do snakes so seldom appear as one of their manifestations?

"As to the suggestions given by figures on carpets or wall-paper, they create illusions, not hallucinations, as their origin deals with defective cognition influenced by the imagination, rather than with the nascent consciousness."

The Sense of Smell.

There is no other cranial nerve which presents so much to puzzle the physicist, the anatomist, and the physiologist as the olfactory. The course of its fibres, from the nasal mucosa to the cortex in the temporo-sphenoidal lobe, is devious and obscure, but the phenomenon of matter of various kinds imparting the sensation of odor by contact with the periphery of the first nerve is still more mysterious. With regard to light and color and all the sounds of the octave, we have long been able to conceive of their reception and differential appreciation by the cortex as due to vibration and variation in vibration rates. The wave theory accounts satisfactorily for these visual and auditory phenomena.

There are some well-known facts concerning the olfactory sense which have always been matters of daily familiarity, but which we have not as yet scientifically interpreted. For instance, as Dr. F. Peterson points out in the *New York Medical Journal*, some odors, though mingled together, can still be dissociated and recognized by the olfactory nerve-ends, whereas others, on the contrary, overwhelm one another, so that one only may be perceived, the others being completely suppressed. This antagonism has been little studied, and has been generally dismissed by the physiologist under the assumption of a chemical process occurring in the mixture. As illustrating this internecine warfare among smells, the odor of almonds conquers that of musk; certain ethereal oils destroy the unpleasantness of iodoform; orris-root is employed against bad breath; sulphuric ether overcomes Peruvian balsam; camphor makes the odors of the oils of lemon and juniper, of petroleum, of cologne, and of onion disappear; and coffee and cloves have the reputation in our drawing-rooms of being inimical to certain spirituous exhalations.

There seems, then, to be a sort of strife between odors of various kinds, a strife inexplicable upon any simply chemical theory; and it is more than probable that the vibratory hypothesis must needs be accepted to account for the sensation of smell as well as for those of light and of sound. Not long ago Professor Haycraft (*Brain*, July, 1888) made some investigations upon the olfactory sense, from which he drew the conclusion that the sense of smell as well as that of taste depended upon the rate of vibration of gaseous particles; and he found, moreover, a relation existing between the molecular weights and vibrations of bodies and the odors which they exhaled.

More recently Dr. Zwaardemaker, of Utrecht (*Fortschritte der Medicin*, Oct. 1, 1889), has been studying the same subject in a manner to throw additional light upon the difficult problem. He has constructed an instrument which he calls an olfactometer. It consists simply of a glass tube, one end of which curves upward, to be inserted into the nostril. A shorter movable cylinder, made of the odoriferous substance, fits over the straight end of this glass tube. On inhaling, no odor will be perceived so long as the outer does not project beyond the inner tube. The further we push forward the outer cylinder the larger will be the scented surface presented to the in-rushing column of air, and the stronger will be the odor perceived.

Should one desire to study the effect of mingling two odors, it is only necessary to saturate the cylinder of the olfactometer with one scented body, and another cylinder with another. By the juxtaposition of the ends of the two cylinders, the lengths being accurately determined, the air rushing in upon inhalation through the tubes must take up and mingle the two odors. Dr. Zwaardemaker found by this means that whenever one outweighed the

other, he perceived the one or the other smell, but that when both were in exact equilibrium, either no odor at all was perceived, or at most a very weak and uncertain impression was made, which partook of the qualities of neither of the two substances employed.

But as some sort of union of the gaseous molecules could not be altogether excluded by this method, such as an indifferent osmotic or physical combination preventing sensory perception, it was deemed expedient to make use of a double olfactometer in experiments of this character. The instrument consists merely of two of the olfactometers described above, one for each nostril. By the use of the double olfactometer one may easily convince himself that even in this procedure one odor will overwhelm another, rubber, for instance, causing the smells of paraffin, wax, and tolu to disappear. Even with very strong excitants there is never a mingling of sensations. Either the one or the other odor is distinguished by one or the other nostril, until, by careful equilibration of the two, no sensory effect is at all perceived. Sensibility is absolutely eliminated. Each nasal half becomes in this manner completely insensible to the odor inhaled through it, although its sensitiveness is really the same as before.

We are constrained to believe that there is something in the vibratory theory already applied to sight and hearing, to account for these remarkable facts in the domain of smell, and that is the interference of molecular waves with each other, producing in the former cases darkness and silence, and in the latter temporary anosmia.

NEUTRALIZATION OF THE BACILLUS OF TETANUS. — In June last Professor Sormani of Milan announced to the Lombard Institute of Sciences the results of his experiments on the neutralization of the tetanigenous microbe — results which seemed to justify his conclusion that iodoform, iodol, and corrosive sublimate are absolutely destructive to the bacillus in question. To these disinfecting agents he has, says the *Lancet*, as the result of further experiments, added three more — namely, chloroform, chloral hydrate, and camphorated chloral, the latter being, he alleges, in a marked degree efficacious; while camphor and camphorated alcohol he found inert. On a general review of the whole, however, he gives the preference to iodoform. Seven rabbits were inoculated with materials charged with the tetanigenous virus. From six of these, after an interval of twelve hours, the foreign body was removed during the period of incubation; from the seventh the substance was removed only when the first symptoms of local tetanic convulsions had declared themselves. In all these animals the wound was scraped and thereafter freely medicated with iodoform. The seventh rabbit died of tetanus. Of the first six five were saved. From this Dr. Sormani concludes that medication of wounds with iodoform ought to be practised before the setting in of the first tetanic symptoms. Nevertheless, even during declared tetanus, the application of iodoform to the wound is capable of disinfecting it and of removing from it all trace of virulence. Wounds and sores treated with iodoform, especially wounds or sores contaminated with earth, yield results highly welcome to the surgeon — such medication preventing the access of that fatal tetanic symptom which, having once declared itself, leaves but little chance for skilled interference. Dr. Sormani gave confirmatory proof of his thesis by cases of tetanus in hospital, where iodoform opportunely applied saved the patients, and where, from its use having been unfortunately suspended, two lives were sacrificed.

BOXING THE EARS AND ITS RESULTS. — We would fain hope that, in deference to repeated warnings from various quarters, the injurious practice of boxing the ears, once common in schools, is fast and surely becoming obsolete. It is too much to say that this desirable end has yet been realized. Certainly the recent observations of Mr. W. H. R. Stewart do not give color to any such view. In a pamphlet on "Boxing the Ears and its Results," lately published, and referred to in the *Lancet*, Dec. 21, 1889, he briefly summarizes his own experience in the matter. Notwithstanding the toughness of the aural drum-head, its tense expanse will rupture too readily under the sudden impact of air driven inward along the meatus, as it is in the act of cuffing; and Mr. Stewart shows that in one instance at least this injury resulted from a very slight though sudden blow. Given early and skilled attention the

wound may heal very kindly, but if the beginning of mischief be overlooked, as it often has been, further signs of inflammation soon follow, and a deaf and suppurating tympanum is the usual result. There is practical wisdom in the statement that this consequence most readily follows in the case of the poorly developed and underfed children who abound in every board school. In them an ear-ache would probably receive no very strict attention, and disease might for a time work havoc unimpeded. Where chronic suppuration exists already, and it is only too common, a random knock on the ear may, and has resulted, in fatal brain complications. The close connection between ear and brain should never be forgotten, and the reflection that injury to the former organ most easily terminates in total deafness, and in suppuration which may any day take a fatal course, should assist in the preservation of a sometimes difficult patience.

BOOK-REVIEWS.

First Lessons in Political Economy. By FRANCIS A. WALKER. New York, Holt. 12°.

PRESIDENT WALKER in this work has undertaken to bring economic science down to the comprehension of a younger class of students than have hitherto pursued the subject, those from fifteen to seventeen years of age. To accomplish this task is not easy, and the author himself expresses some misgiving as to the success of his undertaking; for he has not treated his theme in a childish, or so-called popular, way, but in a thoroughly scientific manner and with the same closeness of reasoning that is employed in larger treatises. How far his book is adapted to its purpose — only actual trial, as he says, can tell; but if the subject can be made comprehensible to such young pupils, we should think this work well fitted to do so. It is perhaps as simple in style as a treatise on economics can be, and it is in the main free from controversial matter. It contains, however, some things that might better have been omitted; such, for instance, as the discussion of the multiple standard of deferred payments, which is of no practical importance, and is out of place in an elementary work.

The book is divided into two parts, the first treating of production and exchange, the second of distribution and consumption, and the various subdivisions are in general well made. President Walker's views are so well known that we need not state them, and in most cases we find ourselves in accord with them. His theory of profits, however, we cannot agree with, and we fail to see the cogency of the reasoning by which he endeavors to support it. He holds that "prices are determined by the productive capability of the lowest class of employers who are actually producing for the supply of the market; and all excess of those prices, over the cost of production in the hands of the more capable men of business, goes to these latter, individually as profits" (p. 222). But it seems to us that prices are determined rather by the higher class of employers, who by superior ability or larger command of capital often force prices down so that the lower class of employers are driven out of business. Moreover, President Walker, like other economists, overlooks the fact that the highest profits, as a rule, are not made in production at all, but in exchange. But though we cannot agree with all the author's views, we shall be glad if his work should be successful in teaching economics in the high schools.

AMONG THE PUBLISHERS.

THE fourth volume of M. Grandeau's "*Etudes Agronomiques*," just issued, contains a review of British and American agriculture, as represented at the Paris Exhibition.

— M. Victor Giraud, the African explorer, has just published the narrative of his explorations in the African Lake Region from 1883 to 1889. The work contains many illustrations.

— The fifth part of the second volume of the *Internationales Archiv für Ethnographie* has been issued. It maintains in all respects the high level reached by previous numbers. Among the contributions are an article in German, by F. Grabowsky, on death,

burial, and the funeral festival among the Dajaks; and one in English, by Prof. H. H. Giglioli, on a singular obsidian scraper used at present by some of the Galla tribes in southern Shoa.

— Mr. Charles Hallock, the founder of American journalism on field and water sports, and one of the most eminent writers on outdoor life, is now permanently associated in the editorial conduct of *The American Angler*.

— Harper & Brothers have just published Stanley's letters, telling the story of Emin's rescue, accompanied by illustrations and a map showing the traveller's route from the Kongo to the coast. Sir William Mackinnon, chairman of the Emin Pasha Relief Committee, adds some interesting material to the volume. It is of course understood that this book will not in any way trench upon Mr. Stanley's great work, which cannot possibly be published for several months.

— The J. B. Lippincott Company publish this week "A Conversation on Mines Between Father and Son," a lecture on the atmosphere and explosive gases by William Hopton, to which are added questions and answers to assist candidates to obtain certificates for the management of collieries; and "A Text-Book of Assaying," by J. J. and C. C. Beringer, for the use of students, mine managers, etc.

— D. Lothrop Company publish this week a little volume addressed to all workers with hand and brain, entitled "The Shop," devoted to the possibilities and probabilities of social, home, church, and political reform, by Albert E. Winship, editor of the *Journal of Education*.

— The second report of the committee appointed by the British Association to inquire into, and report upon, the present methods of teaching chemistry, which was presented at the Newcastle meeting, and to which attention was called in *Nature* a short time ago, has now been put on sale by the Council. It may be obtained from the office of the Association, 22 Albemarle Street, London, W.

— A new fortnightly scientific periodical is about to be published in Paris. It will be entitled *Revue Générale des Sciences Pures et Appliquées*, and will deal with the mathematical, physical, and natural sciences, and with their applications in geodesy, navigation, engineering, manufactures, agriculture, hygiene, medicine, and surgery. According to the preliminary statement, the new periodical will take as its model the method of exposition adopted in *Nature*. The editor is M. Louis Olivier, and the list of contributors includes many of the most eminent French men of science. The first number will appear on January 15, 1890.

— In the article which Herbert Ward will contribute to the February *Scribner's*, on "Life Among the Congo Savages," there will be an account of the human sacrifices which take place on the death of an African chief. Mr. Ward's article is to be a description of the manners and customs which prevail in that region which Stanley has opened to commerce. Colonel W. C. Church, in his first article on John Ericsson, in the same number, relates that, as the last hour in the life of the great engineer was drawing to its close, he called to his bedside his faithful friend and secretary, and, looking into his face with a smile, said: "Taylor, this rest is magnificent; more beautiful than words can tell." William Henry Bishop, the American novelist, tells in the February *Scribner's* of a recent visit to Galdós, the author of "Doña Perfecta," in his Madrid home. "He came into the room with a hard-at-work air and a cigarette between thumb and finger. He is a dark, slender man, of good height, rather loose-jointed, forty-four years old, and with a young look." Galdós, it is said, has had himself elected to the Chamber of Deputies in order to have a chance to study legislative manners at first hand for literary material. W. H. Mallock, author of "Is Life Worth Living?" who has written for the number an article on Hungarian castles—the fruit of a recent visit to that country—says: "Hungary still remains a very interesting study; and though it may at first disappoint those who expect to find in it castles and peasants like the back scene of an opera, it retains enough of the substance, if not of the surface, of the past to throw a considerable light on what has really been achieved, in the

way of changing or bettering the conditions of life generally, by that extraordinary movement which we especially associate with the present."

— The article which is likely to attract most attention in the January number of the *New England Magazine* is that on "The New England Meeting-House and the Wren Church," by Mr. A. R. Willard. Mr. Willard shows how Sir Christopher Wren, who was rebuilding the sixty or seventy London churches, after the Great Fire in 1666, just as our New England fathers were getting able to build meeting-houses with towers and steeples, set his stamp upon our entire church architecture, in city and country, almost from that time to this. The article is illustrated with pictures of Wren's steeples and of our own old meeting-houses. The other illustrated articles are on Montreal in Winter, and the Boston Musical Composers. Professor Jameson of Brown University, in a paper entitled "Did the Fathers Vote?" shows, in a way that is gratifying to those who believe in progress, that however neglectful we are of our political duties, we are in this respect ahead of our fathers in the "good old times" that the croakers talk about. Mr. William F. Dana writes about the Behring Sea Controversy. Mrs. Nina Moore Tiffany begins a series of "Stories of the Fugitive Slaves," telling here of the escape of William and Ellen Craft. Edward Everett Hale, in his "Tarry at Home Travel," talks this month about the Boston Parks and about Concord. Edward Everett Hale, jr., contributes a chapter of colonial history, under the head of "Edward Bendall and the 'Mary Rose.'" "Candlelight in Colonial Times" is another bit of New England history. Browning receives notice in two articles, one by Mr. Robert Niven of London, on "Browning's Obscurity," the other by Miss H. E. Hersey, on "Browning in America," the latter accompanied by a portrait from a recent London photograph. There is an "Old South Lecture" on "Thomas Jefferson and the Louisiana Purchase," by one of the young Old South essayists, Robert Morss Lovett, now a student in Harvard College.

LETTERS TO THE EDITOR.

*.*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

A New Telephone Invention.

WE see by a late number of the *New York Electrical World* that two Canadian gentlemen have made the important discovery that telephone trunk lines may be duplexed the same as telegraph wires. This has hitherto been considered impossible on account of the great dissimilarity between telegraph and telephone currents. It is on this account chiefly that long-distance telephony is more expensive than telegraphy, as only two persons can use the same wires at the same time. By means of the new invention it is claimed that four persons can use the same wires simultaneously and without the least interference. Advantage is taken of the double wire system now in general use on inter-urban trunk lines. Transmitters and receivers are used with double coils, and the apparatus is connected with both branches of the double-wire trunk line. One set of transmitters generates electrical impulses in the two wires in opposite directions, while the other set generates impulses in the two wires in the same direction. By means of these reversing coils one set of apparatus will actuate and be actuated by a set similarly connected, while, on the other hand, it will not affect nor be affected by apparatus with coils dissimilarly connected. In the one case the electrical impulses move only in the metallic circuit formed by the two wires of the trunk line. In the other case the circuit is completed through the subscriber's ground wires. If this invention is found to work as satisfactorily in actual practice as it is claimed to work experimentally, it will necessarily very materially reduce the working expense of long-distance telephone lines.

R.

Toronto, Ont., Jan. 9.

A Peculiar Pipe from the Susquehanna.

I BEG to present the outlines of an Indian pipe which may be interesting as representing the figure of one of the Delaware "Totems." The relic is composed of a dark green steatite, carved into an admirable image of a turtle. Fig. 1 represents the back of the animal, which is well polished and distinctly marked with the lines shown in the figure.

FIG. 1.

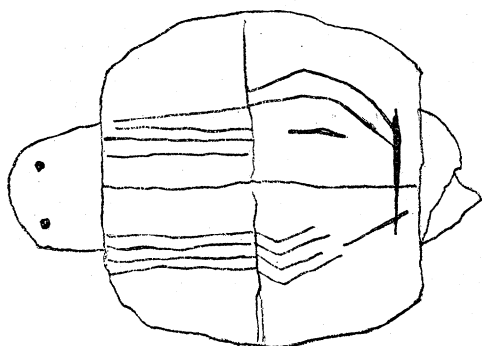


FIG. 2.

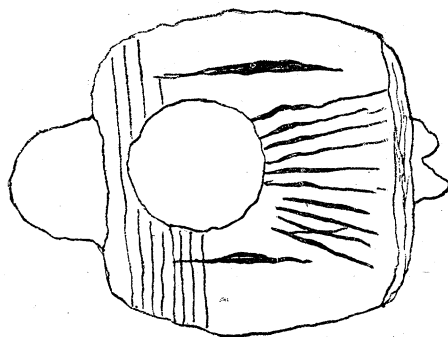


FIG. 3.

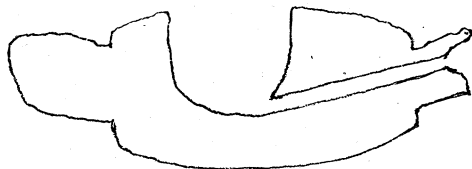


Fig. 2 represents the under surface, which contains the cavity of the pipe and the ornamental (?) markings. The hole for the stem is well drilled, of a smooth bore, and inclined at the angle given in the sketch. This unique specimen was found some thirty years since, by a friend of mine, on the present site of the village of Fairview on the Susquehanna, in close proximity to an old Indian burying ground.

HARVEY B. BASHORE.

West Fairview, Pa., Jan. 5.

Soils and Alkali.

THE last bulletin of the Colorado State Agricultural Experiment Station at Fort Collins published in October and entitled "Soils and Alkali" is issued in the name of Prof. D. O'Brine.

The subject treated is one of acknowledged importance, and for this reason and the fact that it is issued under the auspices of an institution expressly endowed by Act of Congress for the purpose of scientific investigation, renders the fact to which I beg leave to call your attention, especially lamentable.

The first eleven pages of this bulletin are, so far as statement of facts are concerned, practically extracted verbatim from a recent work of my own entitled "Rocks and Soils," and published by Messrs. Wiley & Sons of New York, little more than a year ago.

In support of this assertion I enclose extracts from the bulletin mentioned and from my own work, a comparison of which in parallel columns will demonstrate absolutely the truth of my asser-

tion. I may add further that the specimens extracted embrace only a small portion of the subject matter to which the same assertion would hold true; they are offered however as specimens and *specimens only*.

STOCKBRIDGE (p. 159).

"The quantity of water thus required and evaporated by different agricultural plants during the period of growth has been found to be as follows:

One acre of	exhales	409,832 lbs. of water.
wheat		
clover	1,096,234	" "
sunflowers	12,585,994	" "
cabbage	5,049,194	" "
grape-vines	730,733	" "
hops	4,445,021	" "

O'BRINE (p. 8).

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STOCKBRIDGE (p. 160).

"Dietrich estimates the amount of water thus exhaled by the foliage of plants to vary from 250 to 400 times the weight of dry organic matter formed during the same time."

STOCKBRIDGE (p. 165).

"Hoffmann concluded that the quantity of matter dissolved from the soil by water varied between 0.242 and 0.0205 per cent of the dry earth."

STOCKBRIDGE (p. 166).

The sources of the heat of the soil are three; namely, solar heat, as the sun's rays; heat of chemical decomposition within the soil; and the original or plutonic heat of the earth, proceeding from the still molten earth interior.

The latter source though great in itself yet is so removed from the surface, and the radiation there is so rapid, that this heat is of no considerable value to the plant. The heat of decomposition, though considerable in soils rich in organic matter, occurs only in the presence of comparatively high temperatures, and is therefore not manifest except in soils not needing its action to influence their behavior towards vegetation. The sun, therefore, remains the only source of heat of material importance as related to the production of plants from the soil."

STOCKBRIDGE (p. 125).

"Oats, rye and buckwheat thrive with the lowest amount of organic matter, requiring but from one to two per cent, while wheat and tobacco evidently require most among common agricultural products growing best on the soils containing from five to eight per cent of dry organic matter."

STOCKBRIDGE (p. 127).

The ammonia thus resulting from putrid fermentation undergoes a further decomposition known as nitrification, resulting like the original putrefaction from the action of oxidizing microbes through the activity of which ammonia becomes transformed into nitric acid."

STOCKBRIDGE (p. 124).

"Of the entire weight of all plants not more than five per cent in any case is of soil, or mineral, origin; the remaining ninety-five per cent is wholly of atmospheric origin; most of which becomes added to the soil-mass on the death and decomposition of the plants."

STOCKBRIDGE (p. 154).

"And it is a fully accepted fact that, other things being equal, that soil is invariably most fertile which exists in the finest state of division, whose particles are the smallest."

STOCKBRIDGE (p. 157).

"Liebenberg has shown, however, that the action in the soil may be either upwards or downwards according as the atmosphere is dry or supplies soil-saturating rain."

O'BRINE (p. 8).

Dietrich estimates the amount of water exhaled by the foliage of plants to be from 250 to 400 times the weight of dry organic matter formed during the same time.

O'BRINE (p. 9).

Hoffman has estimated that the quantity of matter dissolved from the soil by water varied from .242 to .0205 per cent of the dry earth."

O'BRINE (p. 9).

The heat comes from three sources: Solar heat, as the sun's rays; heat of chemical decomposition within the soil, and the original heat of the earth's interior. The latter cannot be of any value to plants; the heat of chemical decomposition is not of any value, except in a few special cases. The sun, therefore, remains the only source of heat of practical importance in relation to the production of crops from the soil."

O'BRINE (p. 4).

Oats, rye and buckwheat thrive with the lowest amount of organic matter, requiring from one to two per cent. Wheat and tobacco seem to require most among the common agricultural products, and do their best upon soils containing from five to eight per cent of organic matter."

O'BRINE (p. 5).

This ammonia undergoes a further decomposition called *nitrification*, resulting, like the original putrefaction, from the action of oxidizing microbes, and changes the ammonia into nitric acid."

O'BRINE (p. 5).

Of the total weight of the plants, about five per cent is of soil or mineral origin; the remaining ninety-five per cent is wholly of atmospheric origin; most of which becomes added to the soil mass on the death and decomposition of the plants."

O'BRINE (p. 7).

It is a fully accepted fact that, other things being equal, soil is *invariably* most fertile which exists in the finest state of division, whose particles are the smallest."

O'BRINE (p. 8).

Liebenberg has shown that this movement may be either upwards or downwards, according as the atmosphere is dry or supplies soil-saturating rain."

Before deciding to request the publication of this statement of facts I requested an explanation of Prof. O'Brine, in response to

which request he asserts that the material published over his own name was furnished him in the form of notes by a late colleague who has unfortunately died since the publication of the bulletin in question. These notes were furnished, it is claimed, with the assertion that they were "recent," but that the abstractor had forgotten their source, but supposed that such things were "common property."

I desire to offer no opinion as to the probabilities of such an occurrence, and distinctly disavow all intention of publishing any aspersion concerning a fellow worker. My only claim is that the material published in the October bulletin of the Colorado station was originally mine, and that it was utilized without credit either to myself or the alleged abstractor of the notes in question.

Further, that the order in which the statements made occur is identical with the order in which they occur in the pages of my work alluded to, and that, as is demonstrated in the last extract made, even where my own language is not used verbatim without credit, the *order followed* and the *subject matter presented* are identical with my own. For instance: in discussing the conditions modifying soil temperatures, paragraphs with topic titles were given to "Vegetation," "Condition of Atmosphere," "Angle of Contact," and "Electricity" in exactly the order followed in the last extract made.

Moreover, that frequently tables are given with the identical words of introduction used by myself, although so far as I know the original exists only in German, and the translation and the authority were originally published by myself, though the bulletin alluded to refers to the original in, however, the identical language used by myself as translator.

I desire to make no comments; indeed, none seem to be required. I simply desire publication of the actual facts as a simple matter of justice to myself and to the numerous scientific workers who must be interested parties.

H. E. STOCKBRIDGE.

Queries.

49. INFLUENZA. — Has epidemic influenza been known to cross the equatorial line, in either direction? E. W. GREENOUGH, Sunbury, Pa., Jan. 13.

INDUSTRIAL NOTES.

A New Electric Motor.

A NEW electric motor just brought out by the United States Electric Lighting Company is shown in the accompanying illustrations. It is manufactured in several sizes, from an eighth of a

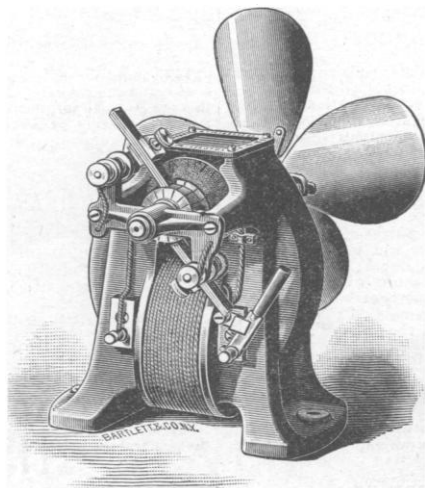


FIG. 1.

horse-power up to twenty horse-power, and wound for any potential up to five hundred volts. In designing these motors, the aim has been to give a very low armature resistance combined with great strength of field, thus securing high efficiency in a motor of comparatively small size. The relative magnetic intensity of field

and armature in these motors is so proportioned that the brushes require a minimum of attention, sparking under any condition of load being eliminated. A great mechanical advantage in their design

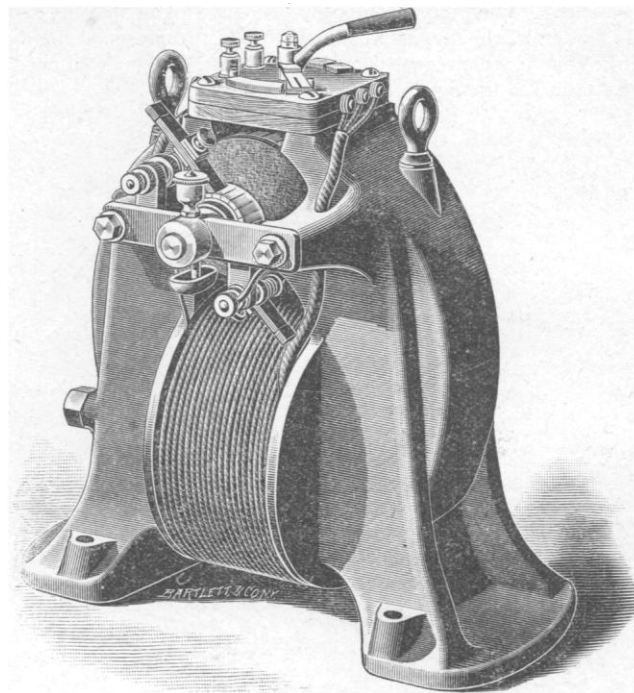


FIG. 2.

is that all armature wires and bands are thoroughly protected from injury by the arrangement of the pole-pieces. The starting device for throwing the motor in or out of circuit is on the motor itself,

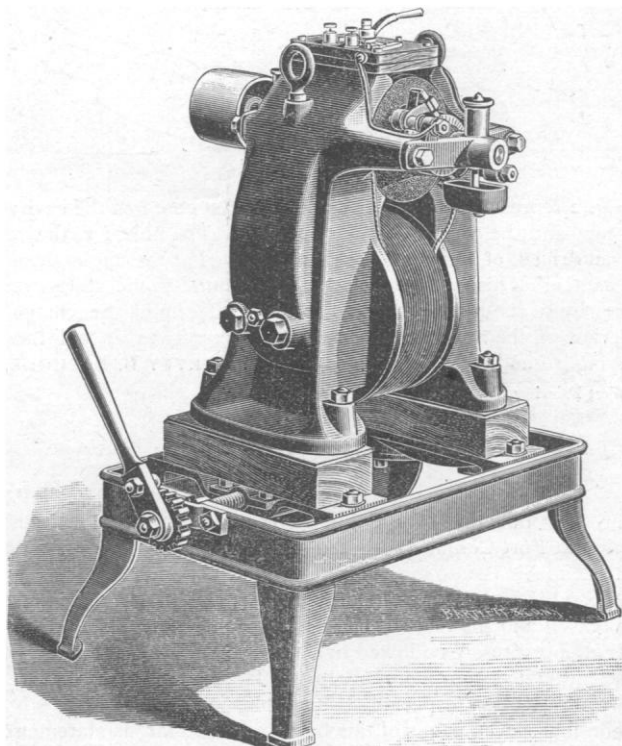


FIG. 3.

resistance boxes being dispensed with. For motors taking a potential above 220 volts a special starting device is used. Fig. 1 shows the motor with fan attachment; Fig. 2 is a motor of larger size, and Fig. 3 shows a motor adjustably mounted on a base.